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(54) Trial lens

(57) A trial lens has a lens surface provided with an index. A stable position of the trial lens on a cornea is measured by the use of the index. The position of an optical center of a contact lens can be determined based on the measurement to set the position of the optical center of the contact lens so as to be matched with individual wearers.

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Description

[0001] The present invention relates to a trial lens which is used to determine an optical center of a non-single spherical surface type contact lens, such as a multifocal lens having a plurality of visual correcting zones with different refractive powers set therein and a toric lens with a degree of lens power for astigmatism correction added thereto, and are also relates related technology thereof.

[0002] As a type of contact lenses for visual correction has been known a non-single spherical surface type contact lens with a lens surface in an optical area including a plurality of spherical surfaces or a toric surface, such as a multifocal lens having a plurality of visual correcting zones with different degrees of spherical lens power, a toric lens with a degree of cylindrical lens power set therein, and a toric-multifocal lens with a degree of spherical lens power having multifocuses and a degree of cylindrical lens power combined therein. Application of a contact lens to a person who has degraded accommodation in an eye refractive power due to presbyopia and so on or has ametropia due to astigmatism has been considered.

[0003] In such a non-single spherical surface type contact lens, it is crucial to position an optical area with respect to a pupil in comparison with a single spherical surface type contact lens which has both lens surfaces substantially formed in a single spherical surface to be used visual correction of spherical ametropia due to myopia or hyperopia. When a non-single spherical surface type contact lens worn by a user has an optical area thereof deviated with respect to an optical center of a pupil of the user by a great deviation quantity, aberration could be produced to fail to exhibit a proper visual correcting ability, degrading clearness in visibility. When a contact lens has an optical center thereof set at a uniform relative position with respect to a geometric center of the contact lens, the contact lens has, in some cases, a deviation quantity of the optical center thereof with respect to the optical center of a pupil increased to fail to exhibit a satisfactory visual correcting function since the stable position of a contact lens on a pupil varies with individuals.

[0004] In order to cope with this problem, it has been proposed that an optometer is used to superimpose a meridian distance measuring pattern over an image with the state of wearing a contact lens photographed so as to compose an inspection image, the stable position of the contact lens on the cornea is measured by the use of the inspection image displayed on a monitor, and the position of the optical center on the contact lens is determined based on the measurement so as to favorably position the optical center with respect to a pupil position, which is disclosed in JP-A-646998 for instance.

[0005] Such a position determination method requires an extensive measuring device including a camera, a monitor, an image processing processor and so on, creating a problem in that the measuring device per se is expensive and difficult to operate. There is a possibility that a measuring accuracy degrades because of misalignment in superimposing a meridian distance measuring pattern over an image with the state of wearing a contact lens photographed.

[0006] The present invention has been devised, considering such circumstances. It is an object of the present invention to provide a novel trial lens for determine an optical center on a non-single spherical surface type contact lens, capable of measuring a position of the contact lens on a cornea or a pupil position on the contact lens worn by a user with ease and a high accuracy without need for an extensive measuring device.

[0007] It is another object of the present invention to provide a method capable of measuring a stable position of a non-single spherical surface type contact lens on a cornea with ease and a high accuracy without use of an extensive device.

[0008] It is a further object of the present invention to provide a novel method capable of determining an optical center of a non-single spherical surface type contact lens with ease and a high accuracy without need for an extensive device.

[0009] In order to attain the objects, the present invention provides a contact lens type trial lens for determining a relative position of an optical center of a contact lens with respect to a geometric center of the contact lens, the contact lens having a lens surface in an optical area formed so as to include a plurality of spherical surfaces or a toric surface, comprising a lens surface in a central portion which substantially corresponds to an optical area of a contact lens, and an index provided on the lens surface of the central portion to identify a certain point on the lens surface of the central portion.

[0010] In the trial lens according to the present invention, the index provided on the lens surface of the central portion can be utilized to promptly determine the position of a certain point on the lens surface with a pair of values, such as coordinate values. By having a wearer wear the trial lens, a pupil position on the lens surface of the trial lens can be measured by the use of the index. By setting the position of the optical center of a contact lens based on the measured values, the contact lens can be favorably provided so that the contact lens has the optical center matched with the pupil position of the wearer.

[0011] When a practitioner has a subject wear the trial lens according to the present invention, the practitioner can examine the trial lens with a naked eye, or through a magnifying glass or a slit lamp if necessary, to measure the position of a contact lens on a cornea. The measurement for determine the position of the optical center of the contact lens can be carried out easily and promptly without use of an extensive device including a camera, a monitor, an image processing processor and so on.

[0012] The contact lens to which the present invention applies includes a multifocal lens, a toric lens (astigmatic lens), a toric-multifocal lens and the like. There is no limitation on the specific structure of the optical area. Specifically, the present invention can apply to a multifocal lens with a plurality of concentric visual correcting zones as disclosed in JP-A-59208524 or JP-A-2217818, a multifocal lens with a plurality of visual correcting zones divided into upper and lower sections in belt patterns as disclosed in JP-A-6395415 or JP-A-1319729, and a toric-multifocal lens as disclosed in JP-A-926558, for instance. The trial lens according to the present invention can be favorably adopted to determine the position of the optical center of these contact lenses, improving a determining accuracy of the optical center of these contact lenses based on measured values. There is no limitation on the material of contact lens to which the present invention applies. The present invention may apply to not only a soft contact lens but also a hard contact lens.

[0013] There is no limitation on the material of the trial lens. Any known material for contact lenses can be adopted to prepare the trial lens. The trial lens may be of not only a soft contact lens type but also a hard contact lens type. In order to obtain an excellent measuring accuracy and consequently to obtain a determining accuracy of the optical center of a contact lens to be worn, it is preferable that the trial lens is of the same type and is made of the same material as the contact lens. The index, which is provided on the central portion substantially corresponding to the optical area of the contact lens, is not necessarily required to cover the entire surface of the optical area of the contact lens since a deviation quantity of the contact lens on a cornea lies within a limited range in general. For example, the index may be provided on only the lens surface in the central portion which corresponds to a central zone of the optical area of the contact lens. If the deviation of the position of a cornea on the contact lens is roughly known in advance, the position of the index may be deviated from the center of the trial lens accordingly.

[0014] It is sufficient for the index to provide a reference element to identify the position of a certain point existent on the trial lens. Although the index can have not only any form but also any reference point, it is preferable that the index is represented by coordinates wherein a relative position of the trial lens with respect to a geometric center of the trial lens is identified with respect to a known point as origin, for instance. More specifically, a reference element, such as orthogonal axes or radial axes with scale representing orthogonal coordinates, oblique coordinates or polar coordinates, a lattice-shaped mesh scale and a dotted mark, can be favorably adopted as the index. More preferably, the geometric center or the optical center of the trial lens which corresponds to the geometric center or the optical center of a contact lens is adopted as the origin of these coordinates, simplifying calculation required for determining the optical center of the contact lens based on measured values.

[0015] The index may be anything visible from outside. The index can be provided by various techniques, such as carving a lens surface by a laser, cutting, drilling or grind-etching, and printing with dye. It is preferable that the index is colored in transparent fashion for instance. Application of such a colored and transparent index can not only reduce or avoid adverse effect to measuring conditions, such as a subject's visibility, but also allows a fine index or many indexes to be provided on a lens surface over a wide range. Thus, recognition by a practitioner, and consequently operating performance in measurement and a measuring accuracy can be favorably improved. When the index is carved into a lens surface, it is preferable that the index is provided on a convex side of the lens, which can reduce or avoid adverse effect to a cornea or a feeling of wearing.

[0016] The trial lens according to the present invention is preferably provided with a stabilizer for positioning the trial lens on a cornea in a circumferential direction of the trial lens. The provision of the stabilizer can position the trial lens on a cornea in the circumferential direction to further improve a measuring accuracy as well as to further facilitate measurement of a pupil position with the use of the index. As the stabilizer can be adopted various conventional techniques, such as a prism ballast structure with a gravity center deviated downwardly, a dynamic stabilization structure with upper and lower peripheral zone of a lens surface thinned in slant fashion, and a truncation structure with a lower end of a lens cut substantially linearly in a horizontal direction. As the stabilizer is preferably adopted the same as the stabilizer which is provided on a contact lens to be worn. Thus, a determining accuracy of the optical center of the contact lens based on a measured value can be further improved.

[0017] It is preferable that the trial lens according to the present invention has a lens concave side formed in a substantially spherical shape to match with a surface profile of a cornea. By such arrangement, the trial lens can offer an improved feeling of wearing to a subject. Since a contact lens has a concave side formed in a substantially spherical surface to match with a surface profile of a cornea in many cases, the provision of a substantially spherical surface on the concave side of the trial lens can favorably bring the stable position of the trial lens much closer to the stable position of a contact lens to be worn, further improving a measuring accuracy, and consequently a determining accuracy of the center of the contact lens.

[0018] It is preferable that the trial lens according to the present invention has a lens convex side formed so as to include a plurality of spherical surfaces or a toric surface. Since such arrangement can bring the trial lens much closer to a contact lens to be actually worn in terms of shape, the arrangement can favorably bring the stable position of the trial lens much closer to the stable

position of a contact lens to be worn, further improving a measuring accuracy, and consequently a determining accuracy of the center of the contact lens.

[0019] In order to solve the problems, the present invention also provides a method for measuring a stable position of a contact lens on a cornea of a wearer, the contact lens having a lens surface in an optical area formed so as to include a plurality of spherical surfaces or a toric surface, comprising using the trial lens according to the present invention, putting the trial lens in a stable position on a cornea of a wearer, and measuring a relative position of the trial lens with respect to a pupil in the cornea by the index provided on the trail lens to indirectly identify a stable position of the contact lens.

[0020] In accordance with the method of the present invention, the trial lens is regarded as a contact lens and the stable position of the trial lens on the cornea is measured by the use of the index provided on the trial lens, indirectly identifying the stable position of the contact lens on the cornea. Since the index on the trial lens is provided on the lens surface of the central portion of the trial lens which substantially corresponds to the optical area of the contact lens, the stable position of the trial lens on the cornea, and consequently the stable position of the contact lens on the cornea can be easily measured by the use of the index without use of an extensive device.

[0021] In order to solve the problems, the present invention also provides a method for determine a relative position of an optical center of a contact lens with respect to a geometric center of the contact lens, the contact lens having a lens surface in an optical area formed so as to include a polarity of spherical surfaces or a toric surface, comprising using the trial lens according to the present invention, putting the trial lens on a cornea of a wearer, measuring a relative position of a geometric center of the trial lens with respect to a pupil in the cornea by the index provided on the trail lens, determining a relative position of an optical center of a contact lens with respect to a geometric center based on a measured value.

[0022] In accordance with the method of the present invention, the position of the optical center of a contact lens to be worn can be easily determined, depending on wearers, based on the measurement of the pupil position on the trial lens by the use of the index provided on the trial lens. The position of the optical center of the contact lens can be determined promptly and simply without use of an extensive device including a camera, a monitor and so on.

[0023] When the position of optical center of a contact lens is determined based on a measured value obtained by the trial lens, it is preferable, in general, that the optical center is determined so as to substantially correspond to a pupil position of a wearer during wearing the contact lens. However, this is not indispensable. The optical center may be deviated from the pupil position on measurement, taking a wearer's daily life, such as a job, into account. Specifically, it is effective to determine the optical center, taking into account that, if a wearer is engaged in a job requiring reading and writing of characters all the time, it is preferable to downwardly offset the center of a visual correcting zone for near vision toward the nose of the wearer, and that, if a wearer is engaged in a job normally requiring distant vision, it is preferable to set a visual correcting zone for distant vision so as to widely extend around the optical center. When the relative position of the geometrical center of the trial lens with respect to the pupil of a wearer is measured by the use of the index provided on the trial lens in accordance with the method of the present invention, the measurement may be carried out with a naked eye or through a magnifying glass, or the measurement may be carried out by the use of a picture or an image with the trial lens worn by the wearer photographed.

[0024] In determination of the position of the optical center of a contact lens according to the present invention, the pupil diameter of a wearer is also measured by the use of the index when measuring the relative position of the geometric center of the trial lens with respect to the pupil of the wearer by the use of the index on the trial lens, and the lens surface profile in an optical area of the contact lens may be determined based on a measured value indicative of the pupil diameter. Such a method can simultaneously measure the pupil diameter of the wearer as well without need for special operation. Based on the measured value, not only the position of the optical center of the contact lens but also the size and the position of respective visual correcting zones in the optical area can be individually set or selected, depending on the position of the wearer's pupil. Thus, the contact lens can be matched with the wearer at an advanced level without significantly deteriorating operating performance in measurement. As a result, the contact lens can exhibit its visual correcting ability as its function in a stable and effective way. In accordance with this method, the measurement can be carried out easily under natural light outdoors or job environment of the wearer. The optical center, and the size and the position of the visual correcting zones can be easily set on the contact lens so as to match with the wearer's daily life.

[0025] In the drawings:

Figure 1 is a front view of the trial lens according to a first embodiment of the present invention;

Figure 2 is a vertical cross-sectional view of the trial lens of Figure 1;

Figure 3 is a schematic view to show how the trial lens of Figure 1 is worn;

Figure 4 is a front view of the trial lens according to a second embodiment of the present invention;

Figure 5 is a front view of the trial lens according to a third embodiment of the present invention;

Figure 6 is a front view of the trial lens according to

a fourth embodiment of the present invention; and

Figure 7 is a front view of the trial lens according to a fifth embodiment of the present invention.

[0026] The present invention will be described in more detail, referring to embodiments according to the present invention shown in the accompanying drawings.

[0027] In Figures 1 and 2 is shown the trial lens 10 according to a first embodiment of the present invention, which is suitably used for designing a presbyopic contact lens. The trial lens 10 is made of the same material as a targeted presbyopic contact lens, and has substantially the same profile and the same optical characteristics as the targeted contact lens.

[0028] More specifically, the trial lens 10 according to this embodiment has a central portion formed with a circular visual correcting zone 12 for near vision having a diameter D. The trial lens also has an annular-shaped visual correcting zone 14 for distant vision formed so as to surround the visual correcting zone 12 for near vision. The visual correcting zone 12 for near vision and the visual correcting zone 14 for distant vision form an optical area 15 that exhibits a visual correcting function. Outside an outer circumference of the visual correcting zone 14 for distant vision is provided an annular peripheral portion 16 as a non-optical area that does not exhibit an effective visual correcting function. In this embodiment, the visual correcting zone 12 for near vision and the visual correcting zone 14 for distant vision are concentrically formed about a single optical center O. The optical center O is coincident with a geometric center P as the center of a lens contour.

[0029] In the trial lens 10 which has a structure matched to a presbyopic contact lens for both of near and distant vision, a wearer normally uses both of the visual correcting zone 12 for near vision and the visual correcting zone 14 for distant vision simultaneously to observe a visible object as in a normal presbyopic contact lens. The wearer can distinguish an image clearly visible by either one of the visual correcting zones 12 and 14 based on his or her cerebral activities to recognize the visible object.

[0030] The trial lens 10 has a rear surface 18 formed in the substantially same shape as the rear surface of a targeted contact lens, or an concave shape matched to the surface shape of a cornea, throughout the entire surface of the rear surface. Thus, the rear surface is formed in a spherical shape (base curve) having a radius of curvature r0 close to that of the cornea of an eye to put the targeted contact lens thereon. The rear surface 18 has an outer circumferential portion formed with a bevel, if necessary, as in the targeted contact lens.

[0031] The trial lens 10 has a front surface 20 not only formed in a convex shape in the visual correcting zone 12 for near vision so as to provide corrected sight effective for near vision but also formed in a convex shape in the visual correcting zone 14 for distant vision so as to provide corrected sight effective for distant vision. In order that the respective visual correcting zones 12 and 14 can exhibit the substantially same refractive powers as the targeted contact lens, it is preferable that the surface shapes of the respective visual correcting zones are possibly closest to those of the targeted contact lens. The front surface 20 is off-centered with respect to the rear surface 18 to provide a prism ballast structure with a gravity center deviated downwardly, and the front surface has a lower part of an outer peripheral portion formed with a slab-off to reduce a wall thickness thereof, allowing the trial lens to be positioned on the cornea in a circumferential direction when wearing the trial lens. It is preferable that the prism ballast structure and the slab-off are the same as those of the targeted contact lens.

[0032] The front surface 20 of the trial lens 10 has an index 22 provided thereon so as to stretch in the visual correcting zone 12 for near vision and the visual correcting zone 14 for distant vision forming the optical area 15. The index 22 is one that a practitioner can recognize with a naked eye or through a magnifying glass with the trial lens worn by a subject (a person who is going to wear a contact lens). Although, for instance, the index 22 may be preferably represented by dyed marks formed by e.g. printing, the index 22 may be marked by a laser or a cutter. In terms of easy recognition by the practitioner, the index 22 is preferably colored. In this case, it is preferable that the index 22 is colored in transparent fashion to prevent the subject from having significantly degraded visibility.

[0033] The index 22 according to this embodiment is represented by orthogonal coordinates that have an X-axis and a Y-axis intersected perpendicularly each other. The X-axis and the Y-axis are formed with scale. The origin of the orthogonal coordinates is coincident with the geometric center P and the optical center O. When the trial lens is positioned by a prism ballast structure, the X-axis direction is a horizontal direction and the Y-axis direction is a vertical direction.

[0034] It is preferable that each of the X-axis, the Y-axis and the scale forming the index 22 is formed in a line width of 0.05 mm - 0.50 mm so as to be visible through a magnifying glass and so on, if necessary, and to ensure a sufficient measuring accuracy. The length and the position of the X-axis and the Y-axis forming the index 22 are determined so that the pupil of an assumed subject wearing the trial lens 10 lies in an area to be capable of identifying a position in the orthogonal coordinates when he or she wears the trial lens 10. In general, it is preferable that each of the X-axis and the Y-axis has a length of 1 mm - 13 mm with the optical center substantially located at the center thereof. It is preferable that the graduations of the scale on the X-axis and the Y-axis are provided at intervals of 0.05 mm - 1.00 mm so as to be visible with a naked eye or through an magnifying glass and so on and to ensure a sufficient measuring accuracy.

[0035] The trial lens 10 thus formed, which is worn by a person (the subject) who is going to wear a contact lens, can measure a stable position of the contact lens on a cornea with the contact lens put thereon. The optical position and other factors of the contact lens can be found based on a measured value to attain optimum design matched to individual wearers. Now, a design method for a contact lens by the use of the trial lens 10 according to the present invention will be described.

[0036] First, a trial lens 10 that has a shape possibly closest to a contact lens to be worn is selected based on data, such as sight and the shape of a cornea, which have been found in a precheck on a person (subject) who is going to wear the contact lens. As shown in Figure 3, the trial lens 10 is put on an eye 24 of the subject and is located at a stable position on the cornea 26. At that time, the subject recognizes a prespecified object at a suitable distance and a suitable position, for instance, to stabilize the position of the cornea 26. Under the circumstances, a practitioner measures the position of the pupil 28 on the trial lens 10 through a magnifying glass and so on, if necessary. This measurement is carried out by finding coordinate values x and y indicative of the center Q of the pupil 28 in the orthogonal coordinates O-XY by the use of the index 22 of the trial lens 10 located in the stable position. In addition, the diameter d of the pupil 28 (pupil diameter) is also found by the use of the orthogonal coordinates O-XY. It is preferable that the pupil diameter d is measured with the brightness around the subject controlled to a certain value or under different brightness.

[0037] The coordinate values x and y thus found represent the center of the pupil 28 of the subject on the contact lens when the subject wears the contact lens. In this embodiment, the coordinate values x and y directly represent a deviation direction and a deviation quantity of the center Q of the pupil with respect to the geometric center P of the contact lens.

[0038] By designing the contact lens in consideration of the measured values (the coordinate values x and y), specifically by designing the contact lens so as to have the optical center thereof deviated by (x, y) in the horizontal direction and the vertical direction with respect to the geometric center P, the contact lens can be preferably design so that the optical center is favorably coincident with the pupil center of the wearer. The optical center of a contact lens is not necessarily required to be coincident with the pupil center of a wearer in design. The optical center may be properly determined, considering a wearer's daily life or other factors. For example, if a wearer spends a lot of time in reading and writing characters, it is effective that a contact lens is designed so as to have the optical center thereof deviated downwardly toward the nose of the wearer.

[0039] By considering the value d indicative of the pupil diameter, the shape and the size of an optical area 15 to be set on the contact lens, or the outer diameter size and the shape of each of the visual correcting zone for near vision and the visual correcting zone for distant vision can be designed so as to be matched to the wearer. Specifically, the contact lens can be designed so as to be further matched to the wearer by designing the shapes and dimensions of both visual correcting zones 12 and 14 so that the visual correcting zone 12 for near vision effectively performs the visual correction when the pupil diameter closes tighter under lighting for reading and so that the visual correcting zone 14 for distant vision sufficiently cover the entire pupil when the pupil expands under darkness, for instance.

[0040] The design method for a contact lens by the use of the trial lens 10 according to the present invention can measure the stable position of a contact lens on a cornea easily and promptly without use of an extensive measuring device and so on. By making use of the measurement result, it becomes possible to determine the position of an optical area 15 on a contact lens and consequently to attain the optimum design of a contact lens so as to be matched to individual wearers, facilitating the design of the contact lens, and improving and stabilizing the visual correcting functions.

[0041] Although the present invention has been explained with respect to one embodiment, the present invention should not be constituted as being limited to the mode specified by the explanation stated earlier.

[0042] Although the trial lens 10 according to the first embodiment has the optical center O coincided with the geometric center P, the trial lens may have the optical center O in the optical area 15 deviated with respect to the geometric center P as shown as a trial lens 30 according to a second embodiment in Figure 4. The trial lens 30 according to the second embodiment is effective in that it becomes possible to use a trial lens possibly closest to a contact lens to be worn when the deviation quantity and the deviation direction of the optical center O with respect to the geometric center P on the contact lens are roughly found by a precheck to a wearer. Although the trial lens 30 has the index 22 set so as to have the geometric center P as the origin irrespectively of the deviation of the optical area, the trial lens may have the index 22 set so as to have the optical center as the origin O as shown.

[0043] It is enough for the index 22 to be set so as to find only the relative deviation quantity and the deviation direction of the origin with respect to the geometric center P in order to identify coordinate values indicative of a certain point. The index 22 is represented by coordinates wherein the origin O' is deviated with respect to both of the optical center O and the geometric center P, which is shown as a third embodiment in Figure 5. The trial lens 32 with the index 22 set according to the third embodiment is effective in that only the position of the origin O' can be deviated so as to correspond to the deviation of the optical center on a contact lens in order to effectively ensure a measurable region for the position of pupil when the deviation quantity and the deviation direction of the optical center with respect to the

geometric center on the contact lens are roughly found by a precheck to a wearer, for instance.

[0044] Although the trial lenses 10, 30 and 32 according to the first through third embodiments use the index 22 represented by the orthogonal coordinates O-XY with the X-axis and the Y-axis therein, there is no limitation on the specific form of the index as long as the index can identify a certain position on the lens. Specifically, the trial lens may have a lattice-shaped index 34 provided thereon so as to cover an area with a certain point identified in the orthogonal coordinates as shown as an example in Figure 6. The lattice-shaped index 34 can make reading of coordinate values easy, providing a further improved measuring accuracy and prompt measurement. The trial lens may use an index 36 represented by polar coordinates including a plurality of radial lines extending about the origin O and a plurality of annular lines concentric about the origin O as shown an example in Figure 7. The provision of the index 36 allows the position of a certain point to be identified by a distance from the origin O and an angle from a reference meridian (e.g. a horizontal line) about the origin O.

[0045] In Figures 4 through 7 wherein the trial lenses according to the second through fifth embodiments are shown, respective elements that have the same as those of the first embodiment are indicated by the same reference numerals as the respective elements of the first embodiment for easy comprehension. It is preferable that the optical area 15 of the trial lenses shown in Figures 5 through 7 have a multifocal surface or a toric surface close to a contact lens to be worn though not shown in these Figures.

[0046] The trial lens according to the present invention can measure a stable position of the trial lens, or consequently a contact lens to be worn, in the circumferential direction (rotational direction) by the use of the index when measuring the stable position on a cornea. The trial lens can favorably set the cylindrical axial direction or other factors of the toric surface based on the measurement.

[0047] Although the present invention can be put into practice in various modes which are changed, modified or improved based on ordinary skill in the art. Such modes are considered as falling within the scope of the present invention as long as the modes are out of the subject matter.

[0048] As clearly seen from the explanation, the trial lens according to the present invention can easily measure a position on a cornea with the trial lens put thereon, by the use of the index provided on the lens surface. Thus, the measurement to determine the position of the optical center of a contact lens can be carried out easily and promptly without use of an extensive device.

[0049] The method for determining a position of a contact lens according to the present invention can directly measure a stable position of a contact lens on a cornea by having a wearer wear the trial lens instead of a contact lens and making use of the index on the trial lens. The measurement operation can be made simple and prompt.

[0050] The method for determining the optical center of a contact lens according to the present invention can determine the position of the optical center of a contact lens, taking into account the stable position on a cornea measured by the use of the trial lens. Thus, the optical center of the contact lens can be easily set at an appropriate position so as to be matched with a wearer, easily realizing optimum designing of the contact lens that is matched with individual wearers.

Claims

1. A contact lens type trial lens for determining a relative position of an optical center of a contact lens with respect to a geometric center of the contact lens, the contact lens having a lens surface in an optical area formed so as to include a plurality of spherical surfaces or a toric surface, comprising:

   a lens surface in a central portion which substantially corresponds to an optical area of a contact lens, and
   an index provided on the lens surface of the central portion to identify a certain point on the lens surface of the central portion.

2. The trial lens according to Claim 1, wherein the index is represented by coordinates wherein a relative position on the trial lens with respect to a geometric center of the trial lens is identified with respect to a known point as origin.

3. The trial lens according to Claim 1 or 2, wherein the index is colored in transparent fashion.

4. The trial lens according to any one of Claims 1-3, further comprising a stabilizer for positioning the trial lens on a surface of a cornea in a circumferential direction of the trial lens.

5. The trial lens according to any one of Claims 1-4, wherein the lens surface includes a concave surface which is formed in a substantially spherical shape to match with a surface profile of a cornea.

6. The trial lens according to any one of Claims 1-5, wherein the lens surface includes a convex surface which includes a plurality of spherical surfaces or a toric surface.

7. A method for measuring a stable position of a contact lens on a cornea of a wearer, the contact lens having a lens surface in an optical area formed so as to include a plurality of spherical surfaces or a toric surface, comprising:

using the trial lens according to any one of Claims 1-6 instead of a contact lens;
putting the trial lens in a stable position on a cornea of a wearer; and
measuring a relative position of the trial lens with respect to a pupil by the index provided on the trail lens to indirectly identify a stable position of the contact lens.

8. A method for determining a relative position of an optical center of a contact lens with respect of a geometric center of the contact lens, the contact lens having a lens surface in an optical area formed so as to include a plurality of spherical surfaces or a toric surface, comprising:

using the trial lens according to any one of Claims 1-6;
putting the trial lens on a cornea of a wearer;
measuring a relative position of a geometric center of the trial lens with respect to a pupil of the wearer by the index provided on the trail lens;
determining a relative position of an optical center of a contact lens with respect to a geometric center of the contact lens based on a measured value.

9. The method according to Claim 8, further comprising measuring a diameter of the pupil by the index when measuring the relative position of the geometric center of the trial lens with respect to the pupil of the wearer by the index provided on the trail lens; and,

determining a lens surface profile in an optical area of the contact lens based on a measured value indicative of the diameter of the pupil.

FIG. 1

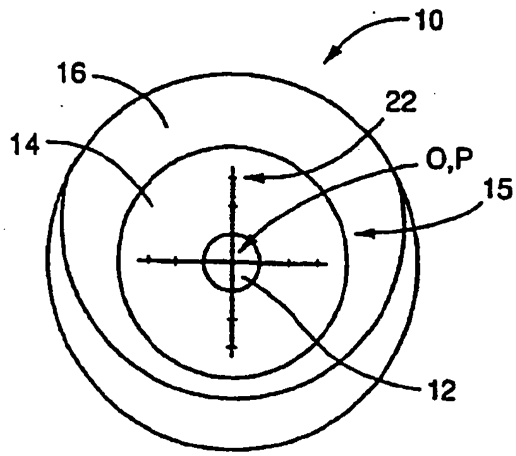


FIG. 2

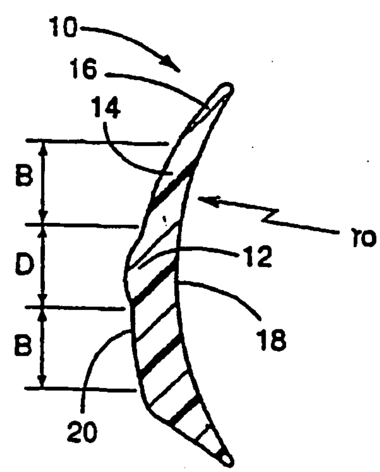


FIG. 3

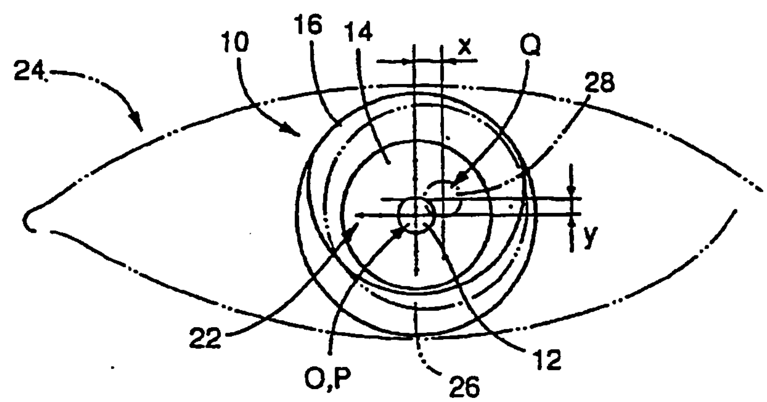


FIG. 4

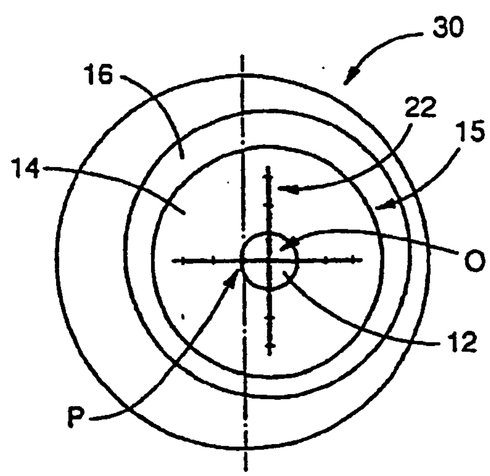


FIG. 5

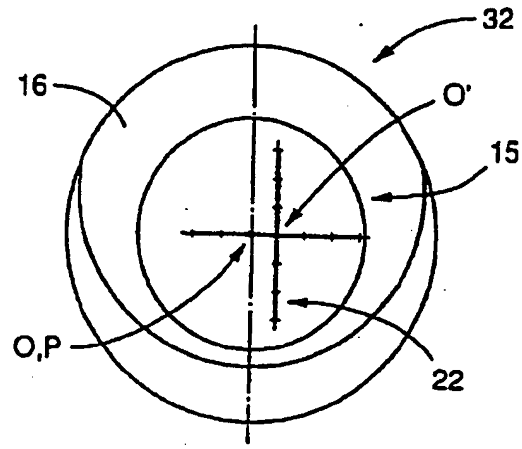


FIG. 6

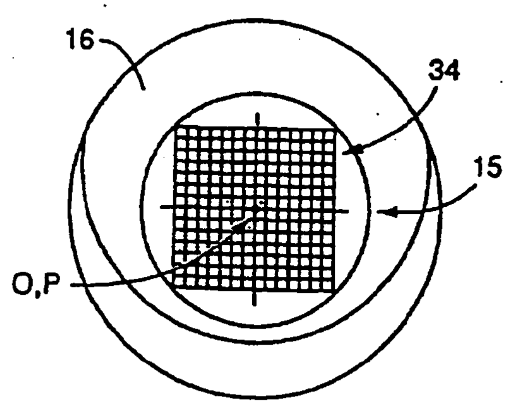
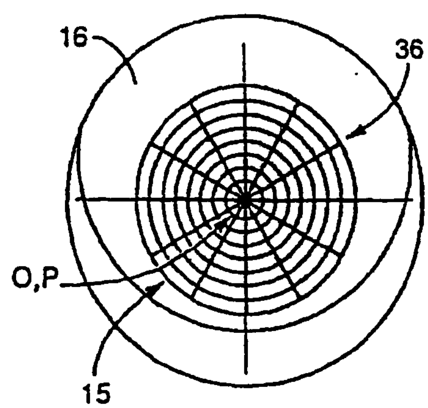


FIG. 7



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(54) **Trial lens**

(57) A trial lens has a lens surface provided with an index. A stable position of the trial lens on a cornea is measured by the use of the index. The position of an optical center of a contact lens can be determined based on the measurement to set the position of the optical center of the contact lens so as to be matched with individual wearers.

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EUROPEAN SEARCH REPORT

Application Number
EP 99 10 6802

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Place of search	Date of completion of the search	Examiner
THE HAGUE	19 November 1999	CALLEWAERT, H

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